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MONTANA STATE HIGHWAY COMMISSION
PLANNING SURVEY DIVISION
HELENA, MONTANA

STATE DOCUMENTS

DEC 9 1974

May 20, 1957

ECONOMIC ANALYSIS OF ALTERNATE ROUTINGS OF INTERSTATE HIGHWAY NO. 101 WITHIN & IN THE VICINITY OF BUTTE, MONT.

FOREWORD

An economic analysis of this type is prepared for the purpose of comparing the relative merit of various proposed routings to assist in the selection of the route which will provide the greatest service to the principal beneficiary of highway improvement, namely, the highway user.

TRAFFIC

In anticipation of the need for adequate traffic information to assist in the planning of highway locations in this vicinity, the Planning Survey Division conducted an origin-destination traffic survey at points on the perimeter of Butte. This survey was conducted during the period of August 20, 1956 to August 27, 1956, inclusive. The stations were operated from 6 A.M. to 10 P.M. on each day. During this period, traffic was interviewed which amounted to approximately 90% of the daily total.

In the origin-destination survey, vehicle operators were stopped at the designated stations and were questioned concerning the origin and destination of their trips. These trips were then classified and summarized by predetermined zones into which the city and urban area were divided. They were also adjusted to a daily average for the 8 day period.

The distribution of trips by principal area and station is summarized below. For this summary, the city of Butte and the adjoining urban areas were divided into three principal areas: the central business district, the area north and west of the Northern Pacific Railway tracks and the area to the south and east of these tracks. In addition, segregation was made of the traffic which traveled through the city without stopping.

STATION NO. 1
EAST OF BUTTE ON U. S. #91

DISTRIBUTION OF TRIPS

	NUMBER	PERCENT
NORTH AND WEST OF RAILROAD TRACKS	3,534	53
SOUTH AND EAST OF RAILROAD TRACKS	702	10
CENTRAL BUSINESS DISTRICT	1,984	30
THROUGH TRAFFIC	432	7
TOTAL	6,652	100

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312

STATION NO. 2
SOUTH OF BUTTE ON U. S. #2

DISTRIBUTION OF TRIPS

	NUMBER	PERCENT
NORTH AND WEST OF RAILROAD TRACKS	2,492	35
SOUTH AND EAST OF RAILROAD TRACKS	1,849	26
CENTRAL BUSINESS DISTRICT	1,442	20
THROUGH TRAFFIC	1,327	19
TOTAL	7,110	100

STATION NO. 3
WEST OF BUTTE ON U.S. #2 - 91

DISTRIBUTION OF TRIPS

	NUMBER	PERCENT
NORTH AND WEST OF RAILROAD TRACKS	2,214	33
SOUTH AND EAST OF RAILROAD TRACKS	1,352	21
CENTRAL BUSINESS DISTRICT	1,480	22
THROUGH TRAFFIC	1,605	24
TOTAL	6,651	100

COMBINED STATIONS

DISTRIBUTION OF TRIPS

	NUMBER	PERCENT
NORTH AND WEST OF RAILROAD TRACKS	8,240	40
SOUTH AND EAST OF RAILROAD TRACKS	3,903	19
CENTRAL BUSINESS DISTRICT	4,906	24
THROUGH TRAFFIC	3,364	17
GRAND TOTAL	20,413	100

This summary shows that 64% of all trips developed from the area north and west of the railroad tracks, including the central business district. The area south and east of the railroad tracks accounted for 19% of the total trips. Through traffic, moving through the city and urban area without stopping, amounted to 17% of the total.

Exhibit "A", which is appended to this analysis, shows the distribution of trips by traffic interviewing station and principal area.

HIGHWAY USER BENEFITS

The attached Exhibit "B" shows a more detailed classification of trips by individual zones. It also shows the existing principal highway network and the three principal alternates suggested for the location of the new Interstate highway.

The proposed alternates were selected by the Interstate Division after a thorough field inspection and review of aerial photographs. They were chosen on the basis of providing the best traffic service and also on the basis that the location would permit the design to conform to the national standards prescribed for Interstate Highways.

In computing the highway user benefits, trip lengths were measured via the most logical and expeditious route from each zone to the common termini of the proposed alternates. In delineating the trip routings, consideration was given to the fact that the typical motorist will make a special effort to use a controlled access facility to the maximum extent on trips involving external origins or destinations. The benefit to the motorist on a controlled access facility is reflected in higher operating speeds with safety, lower accident rates, and lower operating costs.

After the average trip length from each zone had been determined for each of the three alternates, the trip lengths were multiplied by the number of trips from each zone in order to determine the total amount of travel, as measured in vehicle miles, required via the alternates to solve the transportation problem involved in getting the traffic into, out of, or through the city of Butte and the urban area.

The next step involved the computation of the total cost which would be incurred by the highway user, via the alternate routes, in moving from his origin to his destination. This was accomplished by multiplying the number of vehicle miles of travel developed for each route by certain highway user cost factors recommended in a technical publication of the American Association of State Highway Officials. Separate highway user cost factors were used for travel on existing city streets and for travel on the improved controlled access highway. On the average, costs of traveling on the controlled access facility amounted to about two-thirds of the costs of traveling on the more congested city streets of lower standard.

The results of the calculations are shown in the following table, together with highway construction costs as developed by the Interstate Division:

COMPARISON OF HIGHWAY USER COSTS
AND HIGHWAY CONSTRUCTION COSTS

	"A" CENTRAL LINE	"B" NORTH LINE	"C" SOUTH LINE
ROUTE LENGTH (MILES)	6.402	7.683	7.687
AVERAGE TRIP LENGTH	4.190	4.911	5.259
ANNUAL VEHICLE MILES	31,215,000	36,590,000	39,181,000
HIGHWAY USER COST PER VEHICLE MILE	$ .1146	$ .1106	$ .1132
ANNUAL HIGHWAY USER COST	$ 3,576,000.00	$ 4,048,000.00	$ 4,434,000.00
HIGHWAY USER COST PER TRIP	48.0¢	54.3¢	59.5¢

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	"A" CENTRAL LINE	"B" NORTH LINE	"C" SOUTH LINE
TOTAL CONSTRUCTION COST	$5,465,000.00	$6,266,000.00	$ 5,638,000.00
CONSTRUCTION COST PER MILE	$ 854,000.00	$ 816,000.00	$ 733,000.00
ANNUAL AMORTIZED CONSTRUCTION COST (40 YEAR LIFE)	$ 136,000.00	$ 157,000.00	$ 141,000.00
CONSTRUCTION COST PER TRIP	2.0¢	2.3¢	2.1¢

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	"A" CENTRAL LINE	"B" NORTH LINE	"C" SOUTH LINE
HIGHWAY USER COST PER TRIP	48.0¢	54.3¢	59.5¢
CONSTRUCTION COST PER TRIP	2.0¢	2.3¢	2.1¢
COMBINED COST PER TRIP	50.0¢	56.6¢	61.6¢
SAVINGS ON "A" CENTRAL LINE OVER 40 YEAR PERIOD		$ 19,811,000	$ 34,606,000

SUMMARY

The following salient facts are disclosed by this analysis:

"A" CENTRAL LINE - This line has a more direct routing, being about 1.3 miles shorter than the other routes. This results in a shorter trip length than either of the other routes. The result is a substantial savings in the number of vehicle miles of travel per year required to meet the transportation situation in this vicinity. It has a slightly higher cost per mile of travel for the highway user, but this higher cost is more than offset by the savings in the number of vehicle miles of travel involved. The net result is a savings to the highway user of $472,000 per year over the "B" North Line or $858,000 per year over the "C" South Line. These savings amount to 6.3¢ per trip over the "B" North Line and 11.5¢ per trip over the "C" South Line.

Although it has a higher construction cost per mile, it has a shorter over-all construction length of about 1.3 mile. This results in a lower total construction cost of $801,000 under the "B" North Line and $173,000 under the "C" South Line. When reduced to an annual cost over an estimated 40 year service life, it saves $5,000 per year over the "C" South Line and $21,000 per year over the "B" North Line. The savings in construction costs per trip amounts to 0.1¢ over the "C" South Line and 0.3¢ over the "B" North Line.

When the highway user savings are combined with the savings in construction costs the "A" North Line saves a total of 6.6¢ per trip over the "B" North Line and 11.6¢ per trip over the "C" South Line. When accumulated over a 40 year period these savings per trip amount to $19,811,000 over the "B" North Line and $34,606,000 over the "C" South Line in favor of the "A" Central Line.

The location of this route is such that the terrain and other features will permit the construction of interchanges to serve the two principal city arterial highways in this vicinity, namely Montana Street and Harrison Avenue. This will preserve the present traffic pattern to a great extent.

"B" NORTH LINE - This routing has the advantage that it is more centrally located to serve the city proper, but in doing so, it follows a circuitous route thereby lengthening both the construction length and the average trip length. The more central location provides for a greater proportion of the trip on the new highway, with the result that the average highway user cost per vehicle mile is lower than either the "A" Central Route or the "C" South Route. This savings in cost per mile, however, is more than offset by the longer trip length with the result that the cost per trip is higher than the "A" Central line. In practically every other consideration the "B" North Route rates less favorable than the "A" Central Route.

The location of this route has the disadvantage that the proximity of the Civic Center at the Harrison Avenue intersection makes it undesirable to construct an interchange at this point. This reduces substantially the benefit which the route would derive through its more central location with respect to the principal areas of the city. The alternative involves the location of an interchange at the Texas Avenue intersection. This location, however, is too far towards the eastern part of the city to be of substantial benefit to a large part of the general area.

This routing is also at a disadvantage in connection with the service to traffic using North U. S. Highway No. 91 which comes from within the city or originates west of the city on U. S. Highways 2 and 91. This traffic must travel a longer distance to get to the interchange at the east edge of the area where the new locations of U. S. Highways 2 and 91 will join. In effect, this type of traffic moves south along the eastern part of the "B" North Line and then travels north again on U. S. Highway No. 91 leading to Boulder and Helena. This involves considerable back travel which is not encountered on the "A" North Line.

"C" SOUTH LINE - This route has the advantage that it would disrupt less of the present development of the city. It would also provide a direct route for the through traffic following U. S. Highway No. 2 through the city. It has the lowest construction cost per mile, and the total construction cost is lower than the "B" North Line, but higher than the "A" Central Line. It requires the longest trip length of the three alternates with the result that it has the highest annual cost to the highway user.

This route is located too far south to be of substantial benefit to the majority of trips with origins and destinations within the city. It would be of benefit to the trips to and from the zones in the southern section of the area, but an inspection of Exhibit "B" will disclose that these zones are a minor consideration in the overall situation. It also has the disadvantage, in common with the "B" North Line, that traffic destined for U. S. Highway No. 91 leading to Boulder and Helena will have to do considerable "backtracking" to get out of the area on the proper highway.

The final result, as reflected in the combined cost per trip of 50.0¢ for the "A" Central Line, 56.5¢ per trip for the "B" North Line and 61.6¢ per trip for the "C" South Line, gives the "A" Central Line a rating 13% more favorable than the "B" North Line and 23% more favorable than the "C" South Line insofar as the highway user's interests are concerned.

EXHIBIT A

DISTRIBUTION OF TRIPS BY STATIONS

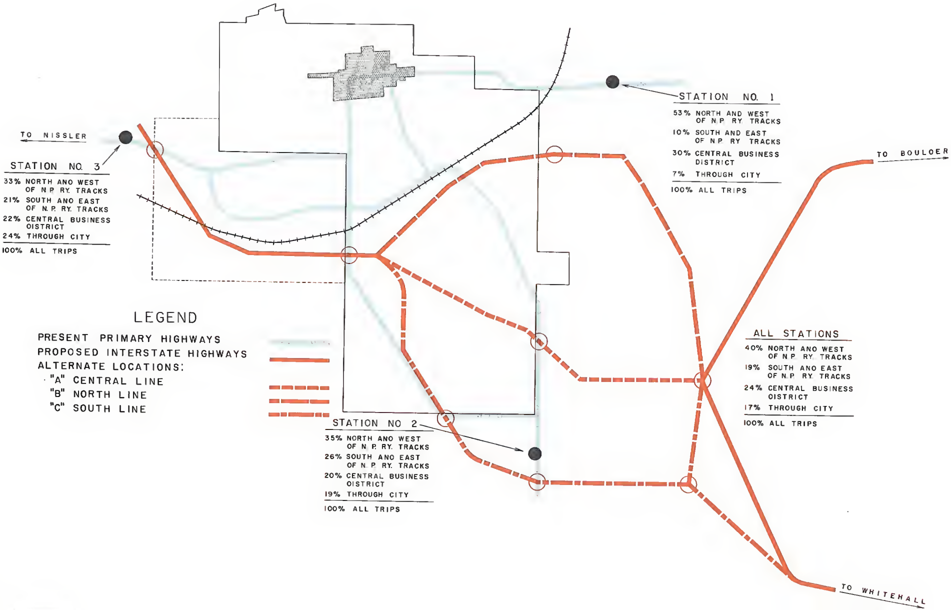
TO NISSLER
STATION NO. 3
33% NORTH AND WEST OF N.P. RY. TRACKS
21% SOUTH AND EAST OF N.P. RY. TRACKS
22% CENTRAL BUSINESS DISTRICT
24% THROUGH CITY
100% ALL TRIPS
STATION NO. 1
53% NORTH AND WEST OF N.P. RY. TRACKS
10% SOUTH AND EAST OF N.P. RY. TRACKS
30% CENTRAL BUSINESS DISTRICT
7% THROUGH CITY
100% ALL TRIPS
TO BOULDER
LEGEND
PRESENT PRIMARY HIGHWAYS
PROPOSED INTERSTATE HIGHWAYS
ALTERNATE LOCATIONS:
"A" CENTRAL LINE
"B" NORTH LINE
"C" SOUTH LINE
ALL STATIONS
40% NORTH AND WEST OF N.P. RY. TRACKS
19% SOUTH AND EAST OF N.P. RY. TRACKS
24% CENTRAL BUSINESS DISTRICT
17% THROUGH CITY
100% ALL TRIPS
STATION NO. 2
35% NORTH AND WEST OF N.P. RY. TRACKS
26% SOUTH AND EAST OF N.P. RY. TRACKS
20% CENTRAL BUSINESS DISTRICT
19% THROUGH CITY
100% ALL TRIPS
TO WHITEHALL

EXHIBIT B

DISTRIBUTION OF TRIPS BY ZONES